

Abstract

Currently, operational weather forecasting systems use observations to optimize the initial state of a forecast without considering possible model deficiencies. For precipitation assimilation, this could be an issue since precipitation observations, unlike conventional data, do not directly provide information on the atmospheric state but are related to the state variables through parameterized moist physics with simplifying assumptions. Precipitation observation operators are comparatively less accurate than those for conventional data or observables in clear-sky regions, which can limit data usage not because of issues with observations but with the model. The challenge lies in exploring new ways to make effective use of precipitation data in the presence of model errors.

This study continues the investigation of variational algorithms for precipitation assimilation using column model physics as a weak constraint. The strategy is to develop techniques to make online estimation and correction of model errors to improve the precipitation observation operator during the assimilation cycle. Earlier studies have shown that variational continuous assimilation (VCA) of tropical rainfall using moisture tendency correction can improve GEOS-3 global analyses and forecasts. Here we present results from a four-year GEOS-3 reanalysis assimilating TMI and SSM/I tropical rainfall using the VCA scheme. Comparisons with NCEP operational analysis and ERA-40 reanalysis show that the GEOS-3 reanalysis is significantly better at replicating the intensity and variability of tropical precipitation systems ranging from a few days to interannual time scales. As a further refinement of rainfall assimilation using the VCA scheme, we describe a variational algorithm for assimilating TMI latent heating retrievals using semi-empirical parameters in the model moist physics as control variables and present initial test results.